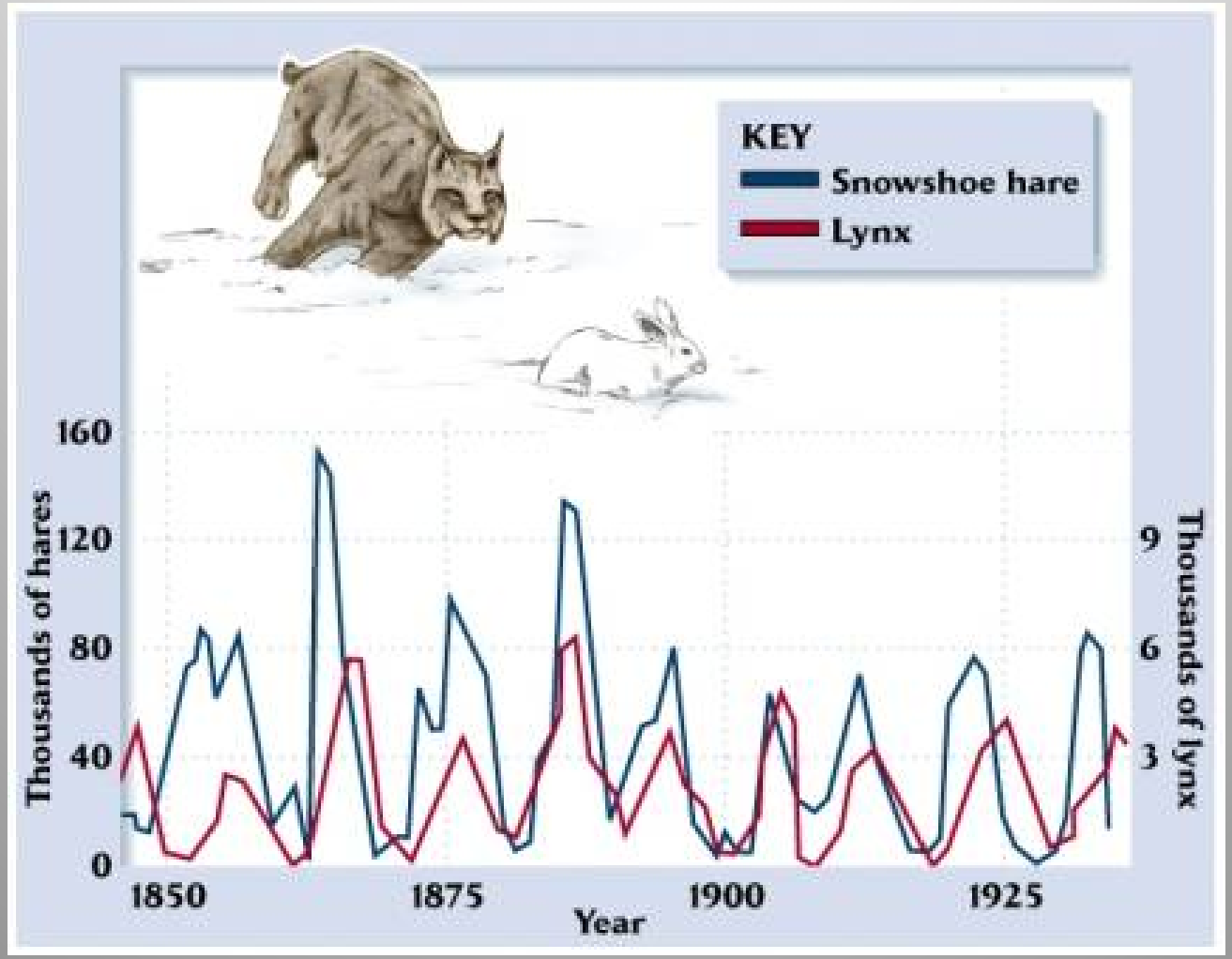
Rough and tough: improving habitat to protect fish stocks

Dr. Paul Gaskell & Shaun Leonard, Wild Trout Trust

Hudson Bay Company pelt records: the textbook classic predator/prey cycling example



Krebs, C.J., R. Boonstra, S. Boutin *et al.*, *What drives the snowshoe hare cycle in Canada's Yukon, in Wildlife 2001: Populations, D.R. McCullough and R.H. Barrett, Editors.* ***1992,*** *Elsevier: New York. p. 886-896.*

Predator/Prey interactions

If nice neat cycles are rare:

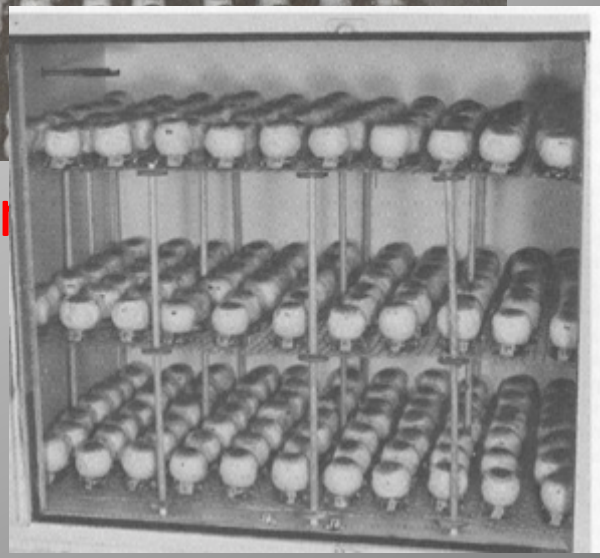
What do we know about habitat influence on predator/prey dynamics?

Old school pure ecology: mites, oranges and rubber balls

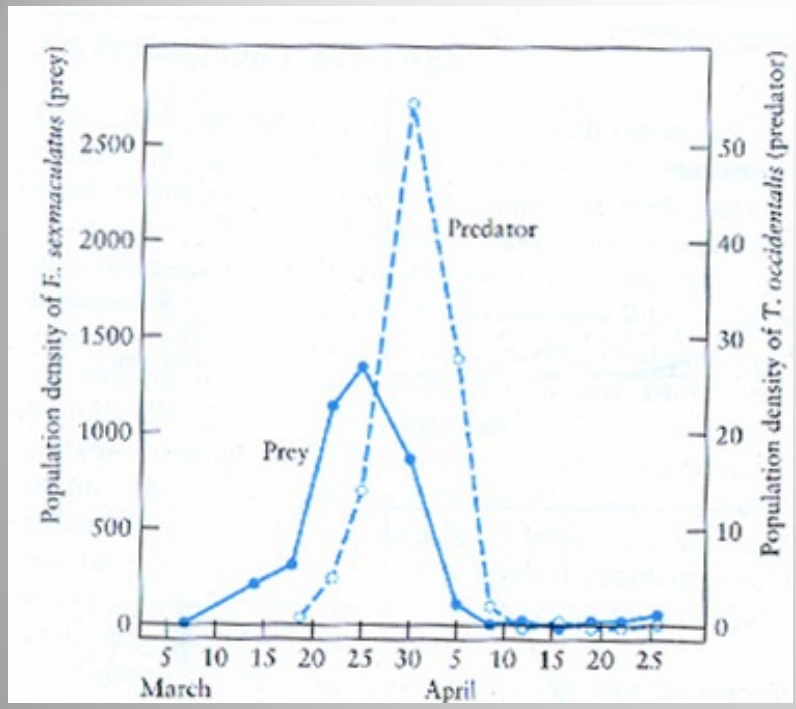
① Huffaker study: predatory + herbivorous mites in constructed 'arenas' to study the effect of habitat complexity

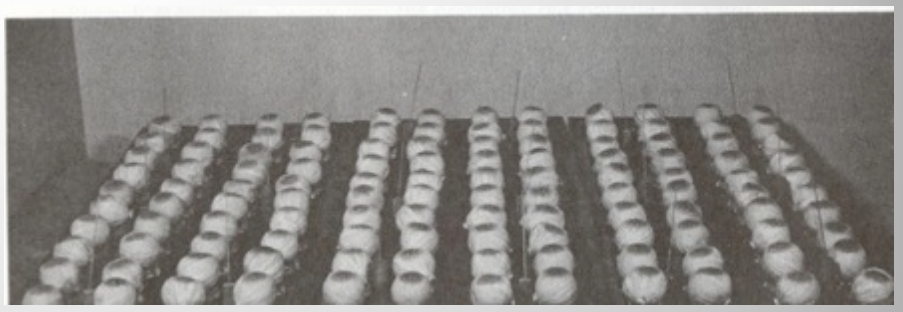
② 'Arenas' included:

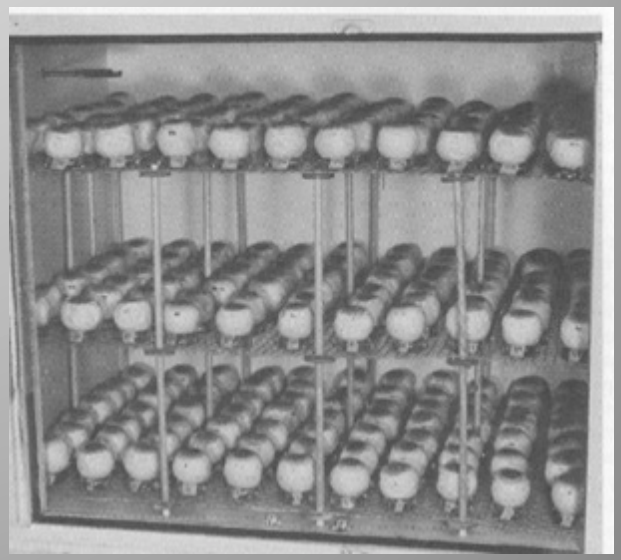
- Oranges (mite food)
- Oranges + rubber balls etc (food + r complex physical environment and refuge)

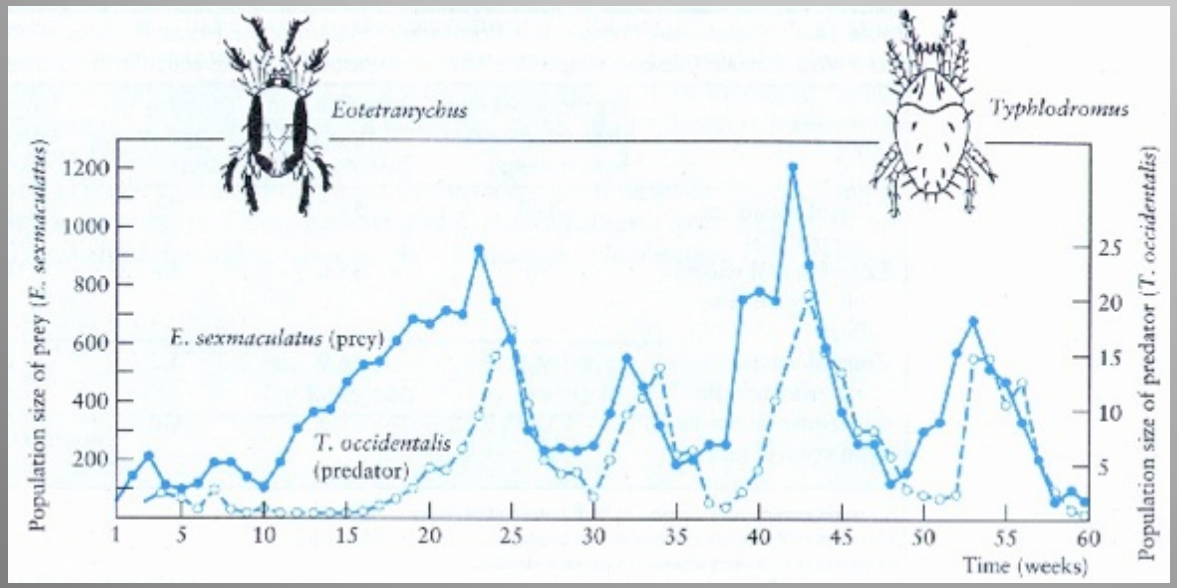


Huffaker, C.B., *Experimental studies on predation: dispersion factors and predator - prey oscillations. Hilgardia, 1958.* ***27: p. 343-383.***


Population density of *E. sexmaculatus* (prey)
Population density of *T. occidentalis* (predator)
Predator
Prey
2500
2000
1500
1000
500
0
50
40
30
20
10
0
5 10 15 20 25 30 5 10 15 20 25
March
April

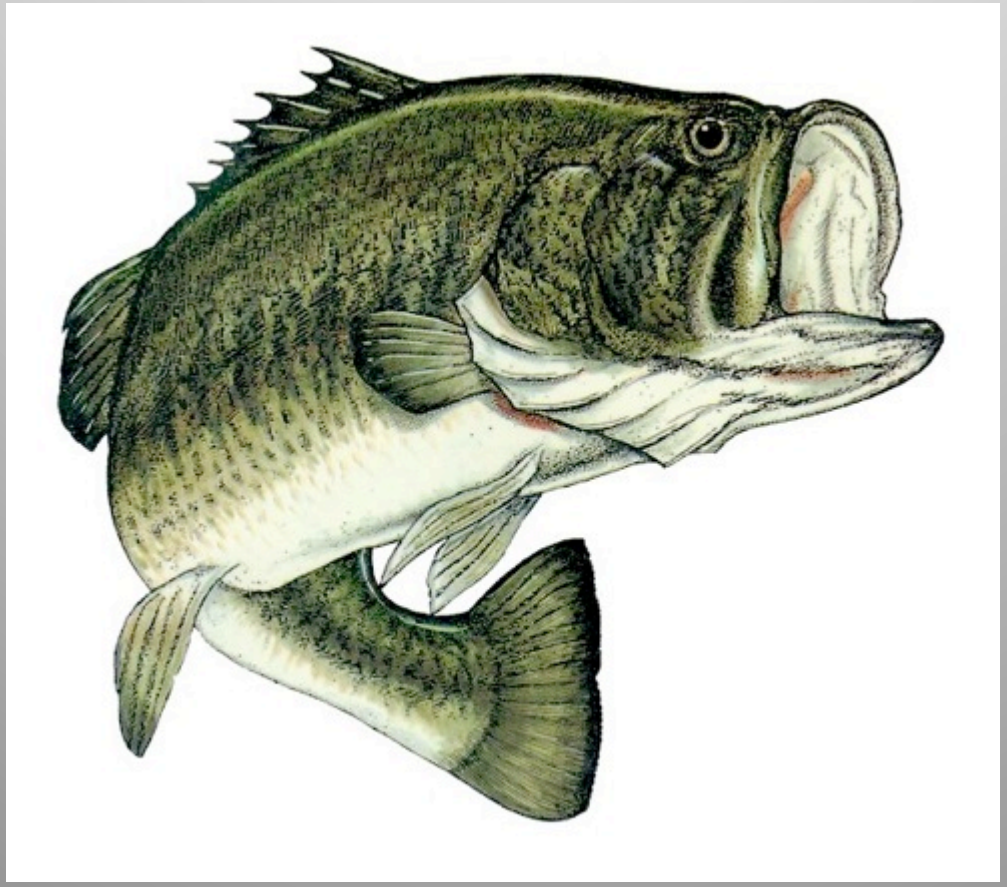




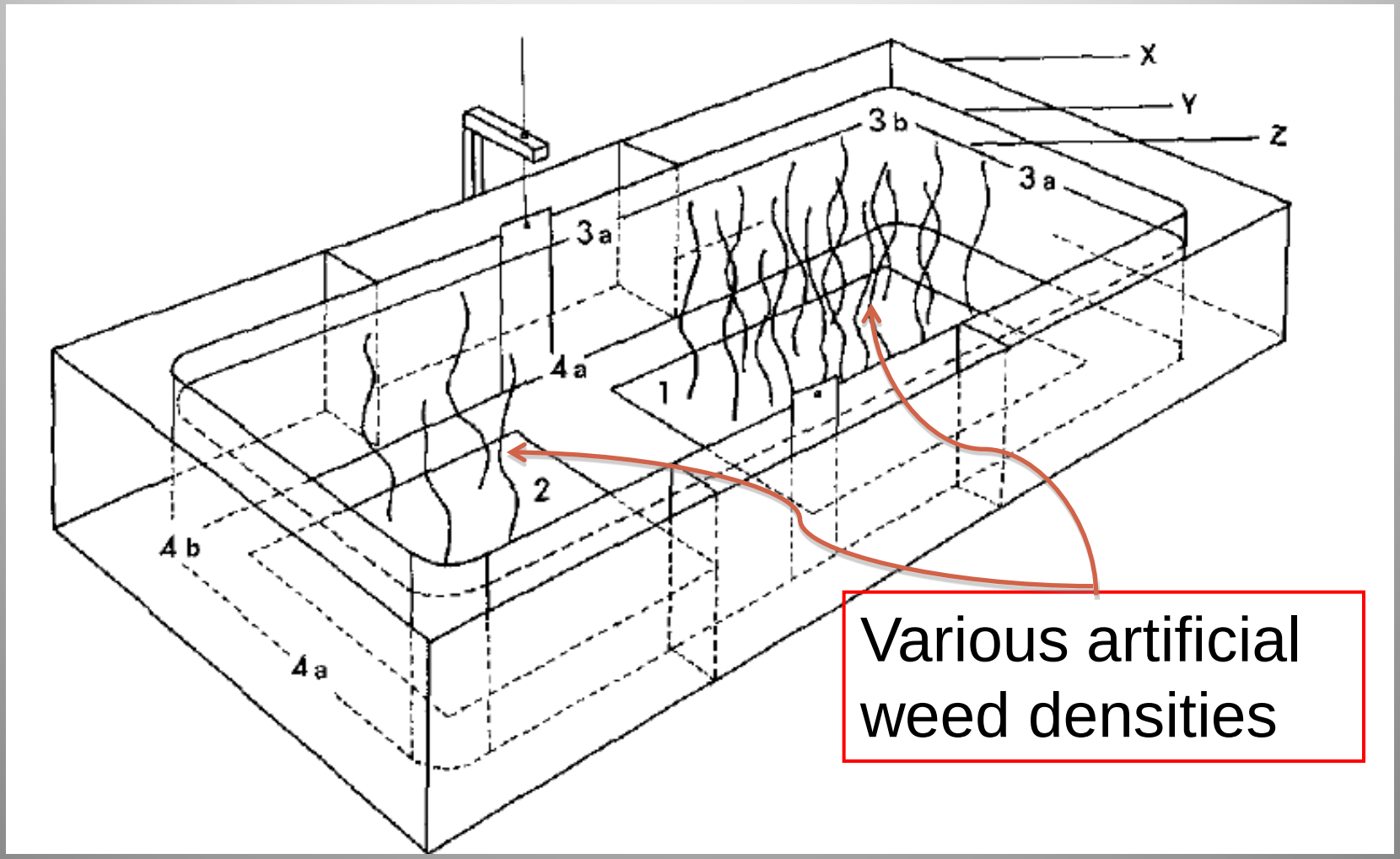

Eotetranychus
Typhlodromus
Population size of prey (*E. sexmaculatus*)
Population size of predator (*T. occidentalis*)
E. sexmaculatus (prey)
T. occidentalis (predator)
1200
1000
800
600
400
200
25
20
15
10
5
1 5 10 15 20 25 30 35 40 45 50 55 60
Time (weeks)

So, might things be similar in fish populations?

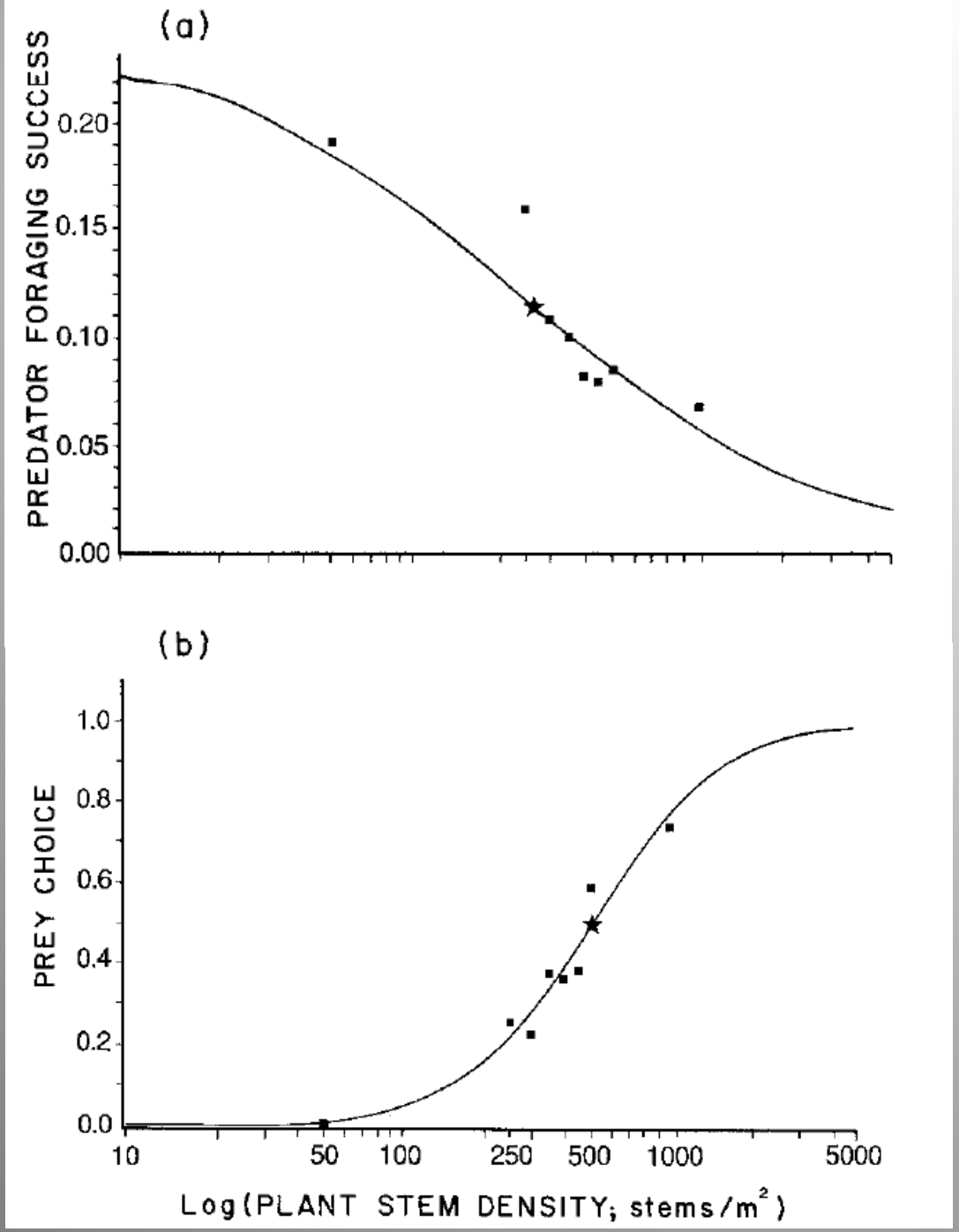
Bring out the Bass!



Bass predation on Bluegills



Gotceitas, V. & Colgan, P. (1989) Predator Foraging Success and Habitat Complexity - Quantitative Test of the Threshold Hypothesis. Oecologia, 80(2), 158-66.



Predator success *decreases* as plant density increases

Bluegills choose denser cover

Refuge work here…

BBC News - River Wear fish protected from birds by 'hedgehogs'

http://www.bbc.co.uk/news/uk-england-tyne-16065724

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7 December 2011 Last updated at 09:22

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River Wear fish protected from birds by 'hedgehogs'

Devices called hedgehogs are coming to the rescue of fish in the River Wear in the first project of its kind in an English river, according to the Environment Agency.

Conservationists have placed 12 spikey, plastic refuges in the river near Prebends Bridge in Durham to give fish places to hide from predators.

Russell *et al.* (2008) UK cormorant study

Russell, I., et al., *Reducing fish losses to cormorants using artificial fish refuges: an experimental study. Fisheries Management and Ecology, 2008.* ***15(3): p. 189-198.***

Classic predictions of habitat complexity versus predator/prey interactions

①In ‘simple’ habitats, predators efficient and systems unstable

①↑ habitat complexity ➔ ↓ predator efficiency and may tend to stabilize the interaction (lower risk of prey extinction)

e.g. Crowder, L.B. & Cooper, W.E. (1982) Habitat Structural Complexity and the Interaction between Bluegills and Their Prey. Ecology, 63(6), 1802-13.

How to make this stuff relevant in wild streams?

To start: what's good and bad habitat?

How does WTT work increase habitat complexity?

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How does WTT work increase habitat complexity?

Would we expect this to protect against bird predation?

- Optimal foraging theory…

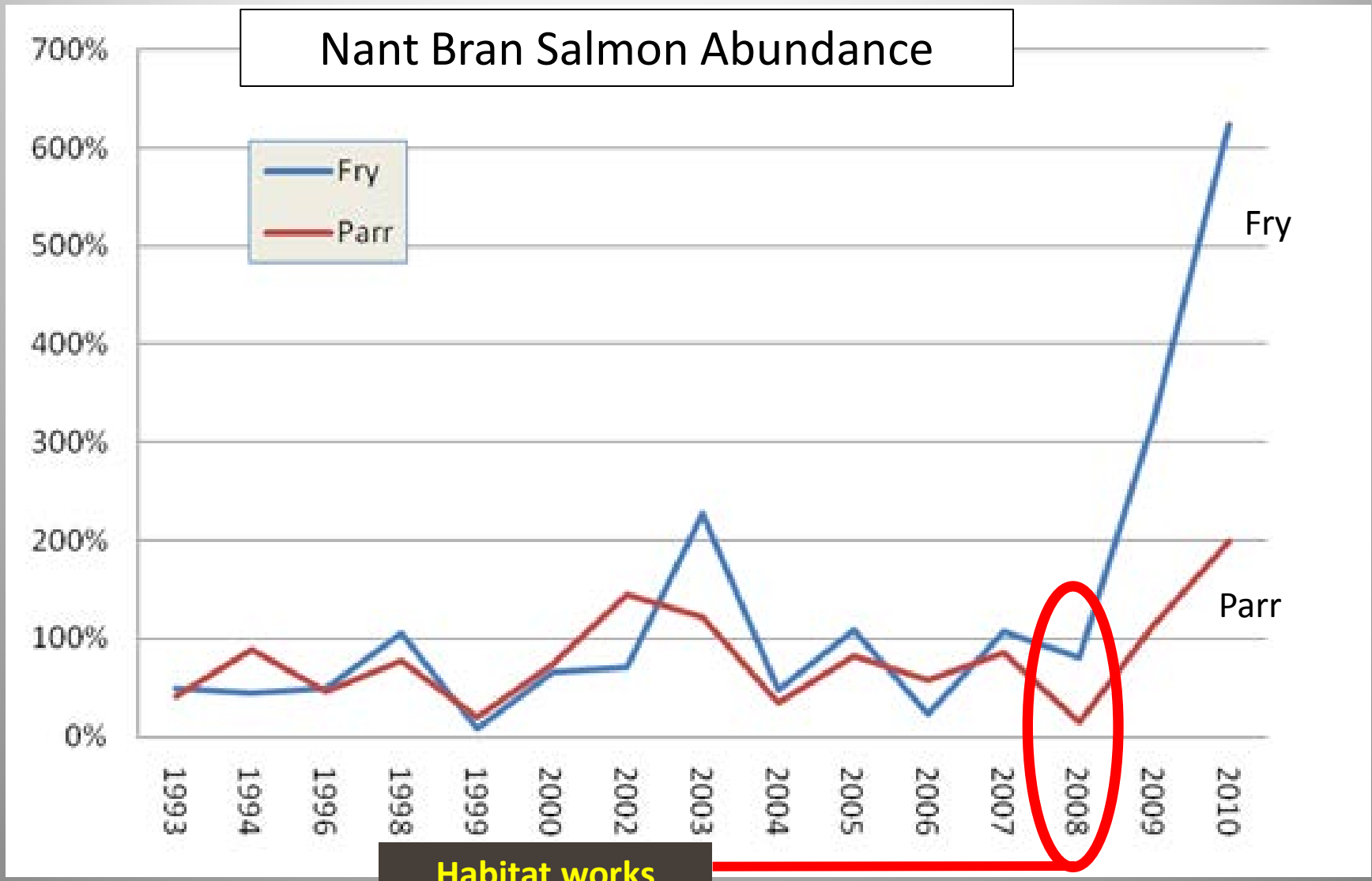
  A predator should leave a patch when its rate of food intake in the patch drops to the average rate for the habitat as a whole

- So, increasing search time and reducing capture efficiency by increasing habitat complexity should make predators give up on a patch sooner

e.g. Pyke, G.H., Pulliam, H.R. & Charnov, E.L. (1977) Optimal Foraging - Selective Review of Theory and Tests. Quarterly Review of Biology, 52(2), 137-54.

Wye & Usk Foundation Work

Any evidence it works?



Habitat Work – Problems not Solutions?

- Land Drainage Consent?
- How to secure LWD/CWD?
- What if the stuff does break away?
- Does it actually work?
- Is it fish aggregation or genuine increased numbers?
- Displaces not removes the issue?
- Not good for some species e.g. grayling?
- River users not happy – perception of ‘rubbish’ in the river!

Best Shot?

- Make and keep your river rough
- Use LWD and CWD
- Fish live in trees!

Photo: C. Rangeley-Wilson